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GEOGRAPHY FROM NATURE.

BY

RICHARD E. DODGE.

Teachers and students of geography are rapidly coming to recognize that the features of a region that we call geographic—the location of land and water in their various forms, the distribution of climatal regions, the habitations of man, his customs, characters, occupations, etc., are very largely determined by physiographic conditions. In order, therefore, to get at the true meaning of the geographic conditions, as we now see them, we must understand the physiography.

Such an intimate knowledge of the geographic features of a region as is most helpful and suggestive cannot be attained unless study is made of the features themselves, as they exist in nature. From the knowledge of the forms and processes to be seen about us, we gain a power to obtain a realizing sense of the geographic conditions of regions of the earth that we can have presented to us only through the words of travellers. Excursions then, for both teachers and students, ought to be a necessary part of geographic training. Excursions are bound to come sooner or later, and this short paper is a plea for their inauguration at once—wherever possible. The beginning may have to be a small one, but let there be a beginning soon. The outlay of time and money is not necessarily large, and I know from experience that teachers are more than repaid for any efforts that they make.

Any locality becomes a possible centre for the starting of such excursions, and under good guidance almost any place becomes profitable for minute and valuable study and illustration. I propose in the following pages to suggest the lines along which excursions should, to my mind, be conducted, and to illustrate my meaning by using New York City as a type centre from which to start. This, with the hope that excursions may be inaugurated in the near future, for the help of the public and private teacher of geography in this city and vicinity.

Analyzing any region of a rugged character, such as New England and New York, we find the physical features to consist of highlands and lowlands and intermediate slopes. The highlands may be of a more or less even altitude and continuous; or interrupted, rugged and serrate. The lowlands may be the seat of streams of varied sizes or of arms of the sea. In any case the topographic forms are as they are now, because of what has happened in the past. They represent the resultant of the interaction of the processes of erosion on materials of varying hardness, modified more or less by the relative height of the land in reference to the sea.

Physiography has to deal with topographic forms as the result of processes which may now be seen in action, and naturally extends its realm to explaining how form has influenced human and organic history. Hence in studying the history of any region, such as New York, the physical features, as the result of process, become the foundation. Let me then first describe the features of the vicinity of New York City in a large way, and then offer a few suggestions concerning localities where a detailed study of processes and form can be made.

If we should climb to the summit of any altitude in north-eastern New Jersey, southern New York or south-western Connecticut, we should find all the harder rocks of the region,—the traps, schists and gneisses,—rising to an accordant skyline, not quite horizontal, but gently rising from sea-level inland. Above that skyland rise a few small peaks. Below it lies a lowland of considerable extent occupied by rivers, as the Hackensack and Passaic.

The even skyline is now known by geographers to show that, in what geologists call the Cretaceous times (day before yesterday geologically) the region hereabouts was worn down to sea-level or base-level. The remnants, or Monadnocks, rising above the sky-line, were the little headlands or islands not worn down, because more resistant or more favorably situated to withstand the processes of erosion. At the end of Cretaceous times there was an uplift of the land in reference to the ocean, which gave new vigor to the streams, and the lowlands now found along the belts of softer rocks are evidences that in the succeeding, or Tertiary times, the regions were again worn down close to the sea.

These two most conspicuous features in our landscape—the skeletal frame that underlies and gives the general character to all our present topography,—are then features that have been made geological ages ago, and have been preserved until now, more or less altered by subsequent changes. The superficial detail of form we find to be largely due to the effects of the last ice epoch, which came at the beginning of the present geological age. The ice ploughed up the western slope of the Palisades, scoring them most beautifully, crossed the Island of Manhattan and, standing with its melting edge over central Long Island, made from the rocks, gravel and sands it was carrying, the moraines that make the backbone of the Island, and the gravel plains that occur to the south and southeast of the moraines.

The last touches to the topography have been given in recent times and are due to the work of the atmosphere, the wind, the ocean and organisms. This work is still going on, though the changes are so small day by day that we cannot at first realize the importance of the process. Finally after the present topography was almost complete as we now see it, the region sank, the ocean waters advanced far inland along the lowlands of the Hudson, East River, and other rivers—once the seats of small fresh-water streams,—and a new line of contact between ocean and land was made. Thus the Bay of New York became a good harbor, with good anchorage, good access to the ocean and inland, well protected from winds and storms and in every way admirable. But for the recent sinking of the region, New York Island would have been but a small hill rising above a general plain nearly seventy-five miles inland.

This story has been read by the geologist and the geographer from the rocks and hills, the valleys and rivers, and we must take it for the basis of our further study, following as much into details as our elementary knowledge will permit.

With its past thus written in its physical features, the vicinity of New York becomes a wonderful field for the study of the relation of topography on the one hand to the conditions that have determined it,—the erosive processes, the geological structure and character of the rocks,—and on the other hand to the things it has largely determined—the human history. It thus becomes a region where, above all others, field excursions to see geography out of doors are very profitable and very possible.

In the conduct of field excursions the following plan seems to me, from some experience, to be the best. After a series of elementary introductory exercises and lectures in the house, the class should be taken out to see those processes in action that can best be studied in the region. The processes, and in a small way their effects, can be studied at the same time. Later, comparisons may be made to larger examples. The processes best to be seen in such excursions are the work of the atmosphere and rivers, wind and frost, the ocean and glaciers, taken in the order named. Any of these may be well seen in the near neighborhood of New York City.

After such a study of the work of the form-producing agents, a study of the larger forms of the region from some elevated peak should be made, and also some study given to the effects of uplift and depression on the rivers and the ocean.

The foot of First Mountain at Upper Montclair, N. J., or the foot of the Palisades, at almost any spot, is a very fine place for the study of the work of the atmosphere, frost, gravity and a river. The vertical cliff of hard rock at the top and the talus of loose material, pulled down by gravity, give us two contrasts of slope whose meaning becomes at once clear to the youngest. The fresh trap compared with the surface of any block exposed to the weather shows the origin of the fine soil that occurs in the talus. The presence of the cracks in the rocks, wet with trickling water and perhaps occupied by small roots of trees, gives a fine example of the weathering and loosening processes at work. The relation of talus to hard rock and the effects of weathering are at once brought home to the observer. That the rocks of the ridge are becoming gradually broken and carried down toward the ocean is accepted without question.

If the excursion be to the foot of the Palisades, the work of the river in slowly removing the débris of the talus, and carrying it down stream in fine particles, is one that any child can and will observe, and thus the far-reaching effects produced by the interaction of the great subaerial processes of erosion and transportation are brought home to the mind of even the most uninitiated. If the student be a child, he at once realizes, as never before, that the shape of the earth is changing, that soil is the weathered rock, that highlands are high because resistant. Geography becomes to his mind for ever after a vital subject and what is even better, it becomes personal. The child feels that work is being accomplished and energy expended, and is impressed thereby. As one is awe-struck and fascinated by the work of a great engine, so we find the child, thus brought face to face with the great forces of Nature in their activity, is fascinated. He at once becomes desirous of watching the forces and studying the detail of form that plays over the features of the earth as the processes go on in their work. A hill is to him no longer an accident. It has a meaning.

If an excursion be made to the foot of a steep slope beside a river as at Fort Lee beside the Hudson, the position of the river in reference to the soft rock can be shown, for soft sandstones outcrop at the foot of the Palisades at that point. That rivers tend to follow the softer rocks is a generalization that can be easily worked up to from this instance. If the Hudson does, the others ought to do so, and a map shows in the house, if we cannot go afield, that all the more important rivers of the vicinity of New York follow limestone belts in the harder schists and gneisses. Harlem River, Spuyten Duyvil Creek, Bronx River and Croton Lake are splendid examples of limestone soft rock lowlands occupied by water channels.

From such a study, passage can at once be made to the influence the rivers, in following the softer rocks, have had upon the paths of movement of man. That the railways follow the rivers and hence the lowlands, is a problem that any child will work out for himself if the suggestions be rightly given. The New York Central, the New York and Harlem River and the New York and Putnam railways are fine examples of such railroad paths. That the physical features of the land have had a great influence in determining certain of the habits of man is at once secured in the mind of the child or teacher, and they are ready to pass to questions a little more complicated or to a study of the other great form-producing processes.

After such a study of a river, a most excellent excursion is to some small ploughed field in the fall or early spring. If that field be on a hillside the formation of river valleys, their parts, the making of alluvial plains and deltas, and all the features of a whole river system can at once be seen in the miniature. Comparisons can be drawn between the features thus seen in a small way and the larger features of noted streams. The Rhine, the Mississippi, the Ganges, the Colorado and many other rivers of note can be shown in type. Above all, a comparative study of the parts of a small system, such as is to be seen in a ploughed field, brings out the meaning of the aging of a river, and the features of young, mature and old river valleys are presented so that the child of seven can at once classify the larger rivers of the world in their most conspicuous features. I have found from experience that teachers of several years' standing found more help from such an excursion as I have mentioned, than from any amount of illustration by picture or word.

After the subaerial processes have been studied as fully as time and circumstances will allow, an excursion should be made to the ocean shore wherever possible. Any shore like Far Rockaway, Arverne, etc., on Long Island or any of the accessible New Jersey shores, are splendid fields for study. Here we can see the ocean at its work of carving the land and carrying away the waste materials,—the chips of the carving,—to the depth of the sea. The work of the waves, the undertow, the tides, etc., can be well brought out. The formation of beaches, their daily change with each incoming tide and wave, the wave marks and ripple marks and the work done by little streams of water on exposed sand flats between tides, are worthy of a great deal of study and full of suggestion. We can at a shore usually see illustrated in a small way all the great processes of continental wear and building. In the pool left between two small ripple marks we may often find the miniature of the land east of the Appalachian summits with the accompanying deposits off shore that extend more than a hundred miles to sea. Once more we can here illustrate small things that at the same time serve to depict the processes so large and extensive that no eye can see them in their entirety.

Another phenomenon very frequently to be seen at a shore is the work of the wind in drifting the sand. We have here in the small dunes the type of the dunes of the Sahara, and on a windy day one gets a good illustration from personal experience of the cutting power of sand. Any of these features may be found along the shore of Long Island and a day, or even half a day, spent there is full of profit and helpfulness and of suggestions to the pupil, or to the teacher whose mind has not yet crystallized into such a state that it cannot adopt suggestions.

The other great form-producing process, the work of ice, cannot be studied in action in this vicinity. We can only study the results. Teachers and children asked to explain the scoring on all the harder rocks, the presence of isolated boulders on a foundation unlike them in composition, the distribution of clay and gravels, must recognize the work of some great agent not hitherto seen. The scratches would indicate a heavy dragging mass of something. The presence of the isolated boulders would suggest a great transporting agent that climbed the hills and paid but little attention to highlands and lowlands. The gravels should in their roundness suggest the work of water, and the morainic accumulations should suggest a dumping-ground where no sorting took place. Central Park, Mt. Morris Park, Van Cortland Park, the heights of Long Island, and many other places show the work of ice wonderfully well. In crossing Long Island to the ocean a fine section of the moraine is seen, and the topography can be well studied. Almost any cellar digging in New York City will show the washed gravels, and there are chances on every hand to bring out the work of ice by illustration and by suggestion. I have found that even the younger children will accept the work of the ice sheet with clearness and without question, and will bring in many illustrations thereof that they have found in their wanderings.

After the processes have been studied thus, an excursion should be made to some unwooded hill, like First Mountain at Upper Montclair, N. J., to get a view of the larger physical features. From such an eminence even the younger children can see the meaning of the flat horizon line. They can picture in their minds that the whole land will in the course of time, other things remaining equal, be worn down to such a plain, close to the level of the sea. They get from this an idea of the great power of what would seem at first to be slight energy acting through a long time. The meaning of highland and lowland, of slopes and of the true office of rivers and ocean, atmosphere, and rain come home to them. Topography has then a meaning and a significance of great importance.

They are then ready to conceive the greater highlands and lowlands of the world and the conditions of the greater rivers. They understand why the seats of several great civilizations have been and are along the plains of an old river. The study of geography can then be made by comparison, and similarity and dissimilarity become the keynote along which advance is made. Geographic features compared to a standard, that of the home locality, have a greater meaning and remain more clear in the mind of the learner than they ever can if they are taken up as if they were unrelated facts having no common cause and to be compared only by position.

Many other processes of a smaller importance might be seen in a few more field excursions, and in any one of the excursions that I have suggested much more can be brought out than I have the time to mention here. The skilful teacher who feels himself more at home out of doors than in, can make a day's trip full of interest from beginning to end. His suggestive mind will find an object of study in small details that would escape the victim of text-book knowledge. Thus the well-trained teacher can teach not only the principles of geography in the field, but also the fact that the story is there for any one who will read it. Apparently trivial things are found perhaps to tell the greatest and most interesting story. Children are taught the value of alertness and of a questioning mind, ever ready to follow the suggestions Nature offers.

After one has seen in the field, from some height, the effects of the rising and sinking of a land, the forms of shore lines in a large way may be attempted. Even the smaller child will see that the shore line of Connecticut or Maine is irregular because the rocks are hard and soft and the ocean has eaten into the softer streaks. They will compare the regions where there are such contrasts of rocks with a region like the shore of New Jersey where there is no such contrast. They will see that a sinking (drowning) of the land would make good harbors along an indented coast and that a smooth shore of either hard or soft rock makes a shore line devoid of harbors, and to be shunned by vessels. A study of the situation of large centres of habitation on the shore of New Jersey and of Connecticut, gives the examples illustrative, at home, of the dependence of man on the shore features and the recent history of the land. The reason for the great civilization and early commerce of Greece and Rome is at once brought home to the mind by comparison.

A more careful study of the effects of drowning upon a land and a river may be made in the case of New York City. The presence of tide water to Albany is an evidence that the region has sunk. A slight demand upon the imagination will serve to bring out the conditions of New York City had there been no sinking. The Hudson would then have been a small stream with water flowing down from a small drainage area, and the East River would have been but a smaller tributary. The effect of this drowning of the Hudson has been of the greatest importance upon the history of the whole continent. Tide water to Albany determined the position of the earlier trading posts there and along the Mohawk, all in easy communication at every season with New York and the Mother Country. It meant the development of agriculture and consequent colonization there and westward, into the great Plains along the natural pathways of commerce. It meant the final triumph of the English over the earlier settlers. It meant the present supremacy of New York City in its commerce, because of its easy communication, on the one hand with the great agricultural and mineral lands of the Western and Central States, and on the other its excellent harbor and easy communication at all seasons with European ports.

Agriculture and mining would have been just as possible had the region stood several hundred feet higher in reference to the sea, but commerce would not have been. That was determined by the recent continental movement that gave conditions favorable to inland trade by the Hudson and Mohawk, for coast-wise trade through the Sound, and of European trade because of a harbor suited for vessels of deep draught. New York, the great seat of the "middle man," the great seat of export trade, has been made possible through many causes, but above all through the recent movements that have made the present physiographic conditions what they are.

That any city depends very largely upon its physical conditions for its growth no geographer at the present time hesitates to affirm. The very great importance of this fact is but more recently coming to be recognized.

The beginner in geography who is striving to master the lines of commerce and trade, the distribution, characters, customs, habits and occupations of peoples, finds these facts to his mind very much the result of accident. Experience may give him the conception, after many years, that topography and the physical history of a region have largely determined the human and organic history. His understanding of geography will be greatly hastened and eased if he can be given the influence of physiography at the start of his study of geography. It becomes the basis of classification of facts, the cause to which he can always refer and get helpful suggestion. Location of places becomes easy, for location is not a thing of accident, but the result of cause.

If a child recognize through observation early in life that form is the result of process and be shown the process, his eyes become opened, his interest awakened, and even very young children find a meaning in "dead" nature that is astounding to them and gives a quality to their conception of life that bears a rich fruit. Although many of the best text-books at the present time are giving geography along the lines of physiography, and are very helpful and suggestive, no child gets such a realizing sense of the actual thing from any source as he does from observation of the fact itself.

If the conditions do not allow of regular excursions for the child, he should be urged to bring in all he can from his own small excursions with parents and friends and from his paddling in the water of the gutter after a rain storm. But if he can see nothing by himself he ought to be given the chance to see through the well-trained eye of a good teacher.

Unfortunately many teachers have not an appreciative and questioning eye for the facts and features of nature, because they have never been trained in that regard. Such teachers if they would accept, should be given a chance to learn something of the features of the world about them from observation. Surely in a city like New York there should be some means provided, either by private or public expenditure, whereby at least those who would might make trips, under good guidance, to neighboring localities for the purposes of field study.

Such field excursions have been given to the teachers of Washington, D. C., with interesting and profitable results. The plan has, I believe, also been tried in several other places. In all the cases that have come to my attention, the teachers have been glad to say that the outings have been of great profit to them.

New York City is very favorably situated for such field studies, and could such a series of excursions be started, many teachers would get at least a glimmer of a few of the ways in which physiography has determined the positions and habits of man. To such teachers geography would come to have some meaning, and the teaching of the subject matter would no longer, to the quickened mind, be but a perfunctory reviewing of pages of text. The spirit of the teacher would not allow any such deadening study of a live subject. In a series of five or six field excursions well arranged, and planned with an idea of leading from one subject rationally to another, the teachers would gain much that would be of great help to themselves in their private lives and in their teaching.

I have taken New York as an example of a centre from which excursions could be easily run because of its favorable situation geographically and because of its many lines of easy communication with points of special interest for illustration. Also because the city itself is such an example of the relation of man, in his progress, to the conditions of a physical nature about him.

New Haven, Hartford, Willimantic, Holyoke, Manchester, Philadelphia, Washington, St. Louis, Chicago and many other large cities are centres of almost equal value for illustration and study. In each case I have mentioned there is very much to be gained from a study of the physical features that have helped determine the position, growth and importance of the city. They are all cities in which the field method of study could be well prosecuted.

At the present time there is a great awakening in the methods of geographic teaching, and now is the time for superintendents, colleges, geographers and geographical societies to be of vast help to the schools by helping in the matter of excursions. The children, if possible, and at any rate the teachers, should be given the chance to study home geography, not from text-books, but from the only perfect geographic reader—Nature herself.

Let us hope that in the next few years excursions for teachers and pupils may become a fixed part of the curriculum in many of our cities and towns. And let us also hope that such a desired end may be hastened through the co-operative interest, beneficence and guidance of geographers, colleges and the geographic societies. The latter especially have, in the organization and conducting of excursions, a field that they can make especially their own and thus come more closely in contact with the people than they have many of them been in the past.

TEACHERS COLLEGE,
New York City.